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ABSTRACT

The development of a computer-assisted instruction simulation (CARE-S) in the Computer-Assisted Instruction (CAI) Center at the University of Texas in Austin is documented. The work is an outgrowth of the CARE 1 CAI program entitled "Early Identification of Handicapping Conditions in Children" which was developed in the CAI laboratory at the Pennsylvania State University and was available to the CAI Center at the University of Texas for use with their students. Using simulation techniques, the CARE-S program assesses the ability of CARE 1 graduates to accurately identify handicapping conditions in young children. (Author)

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A Computer-Based Instructional Simulation For Teacher Training and Evaluation in Special Education

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and
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PREFACE

This technical report describes and documents the development of a computer assisted instruction simulation (CARE-S) by William Cantrell and Agnes Edwards in the CAI Center at the University of Texas in Austin. The work is an outgrowth of the CARE 1 CAI program entitled Early Identification of Handicapping Conditions in Children which was developed in the CAI laboratory at The Pennsylvania State University and was made available to the CAI Center at the University of Texas for use with their students. Using simulation techniques, the CARE-S program assesses the ability of CARE 1 graduates to accurately identify handicapping conditions in young children. Penn State has had a continuing interest in the development of the CARE-S program described in this report and when the authors so generously offered to allow Penn State to reproduce and use the report, we were anxious to do so. We are most grateful to the University of Texas and their faculty for making the program and the technical report available to us.

A COMPUTER-BASED INSTRUCTIONAL SIMULATION FOR TEACHER TRAINING AND EVALUATION IN SPECIAL EDUCATION

The Need for Special Education Teacher Training

Recent developments have increased significantly the need for personnel trained in special education skills. The recognition and definition of exceptionality has been broadened. Weber (1969) has estimated that the number of children in need of specialized services may be as high as 45%. Reynolds (1971), who suggests a more conservative figure, nonetheless estimates that "less than half the children who need highly specialized services are receiving them" (p. 421). The problem of personnel shortage is not lessened but complicated by the current philosophy of many states of retaining the exceptional child in the regular classroom wherever possible (e.g., Texas). The burden of special education is thus redistributed to the regular teacher, who has had little or no training in identifying the exceptional child and in modifying educational programs. Teacher training institutions are presented with the double challenge of developing programs which will provide effectively inservice as well as preservice training.

The Use of Simulation in Teacher Training

The need is not only for more personnel trained in special education skills but for more effective training methods. The desirability of practical experience is generally conceded. However, conventional training methods do not ordinarily afford this. As Vlcek (1966) pointed out:

> Teacher-trainees are given a variety of books and reference materials to study; opportunities to discuss problems encountered daily by teachers in classrooms; and chances to hear veteran teachers describe and explain through lectures, demonstrations, films and other media the art of pedagogy. However, after all this preparation, many teacher-trainees have difficulty transferring their newly acquired knowledge into

> operation during student teaching and first-year teaching assignments. They make mistakes, misinterpret, and lose rapport with their students (p. 96).

Steel (1965) examines three ways of providing needed experience through:

> direct experimentation in the field, theoretical analysis, and simulation. The first is expensive, time consuming, extremely difficult to control and, since one would like to know how not to do something, as well as how to do it, some portion of a generation of children would be badly served. Some predictive mathematical theory would be nice, but no such theory is in sight and even if it were, the likelihood of it being sufficiently tractable to permit predictions in real situations is infinitesimal. We are left with simulation (p. 26).

Short of the real situation, simulation provides the most realistic opportunity for the teacher-trainee to practice his acquired skills. Rice (1966) stressed this learning aspect in his definition of simulation: "Simulation means the re-enactment of a situation, or set of circumstances, or an observable problem for which the learner has to make decisions or take other action" (p. 10). Realistic re-enactments of classroom situations are today possible with the aid of audio and video taping, sound films and electronic computers. However, few teacher training simulations have been developed and only a few of these have made use of computer capabilities. To help fill this gap is the goal of the project herein described, a computer-based instructional simulation for teacher training and evaluation in special education.

Advantages and Problems of Instructional Simulation

Teacher training simulation offers many advantages. Simulation provides a closely controlled environment, enabling the designer or instructor to present the trainee with situations often not readily available in the real world. Yet the artificially created situation which is simulation effects the trainee much as would the real situation. As Beck

and Monroe (1969) point out, simulation provides the trainee with a realistic, responsive environment, giving him a sense of immediacy and involvement. Rice (1966) emphasized the emotional and individual aspect of trainee involvement. For the trainee, simulation provides a complete experience. Similarly, simulation permits the holistic presentation of large or complex systems, which usually must be presented piecemeal, with consequent loss in the desired overview. The holistic presentation, the larger perspective of simulation, is in part made possible by pulling together diverse elements into a limited universe. But of even greater importance is the almost infinite capacity of simulation for altering time (Bushnell, 1963). Simulation permits drastic compression of lengthy, unwieldy time periods, thus greatly speeding up the training process. On the other side, minute periods may be expanded to better illuminate key processes. An important manifestation of time compression is immediate feedback, giving the trainee the most timely advantageous knowledge of the effect of his action (Bushnell, 1963). Moreover, since the simulation environment is controlled, the nature and amount of feedback can be carefully adjusted to the needs of the trainee, as determined by his performance.

While simulation provides the trainee with a realistic experience and enlists his complete involvement, the simulation environment is uniquely unthreatening. The trainee is free to practice decision making without the risk of censure and embarrassment (Twelker, 1967; Cruickshank, 1966). As feedback is symbolical, his errors are free of real-life consequences (Whithed, 1970). This advantage is most easily seen in simulations of high risk environments, as demonstrated by a computerized flight simulator designed by General Electric (White, 1970), and by the computer-based patient simulator for training anesthesiologists (Abrahamson, Wolf, & Denson, 1969). And since simulations are replicable, the trainee may repeat an exercise as often as desired to improve his performance.

The computer capacity for keeping detailed records of trainee performance makes computer-based simulation an effective research tool. As Bushnell (1963) points out, performance data generated in a simulated

environment can be useful in evaluating the trainee's behavior, the efficiency with which he reaches a specific objective and the effectiveness in realizing objectives.

Two problems of simulation are achieving fidelity to the real situation, and the validation of the simulation. Fidelity is of utmost importance in a training simulation since it directly effects the generalizability of results to the real world (Bushnell, 1963). In teacher training the major concern is with positive transfer to the real-life situation. This transfer is largely determined by the exactness of the simulation, by its fidelity. The extent of simulation fidelity, the similarity with the real-life situation, depends on the factors selected for the simulation and their representation (Bushnell, 1963). These processes are frankly of an editorial nature. That is, the designer must decide what factors should be represented in the limited simulation universe, and he must assign relative values to each. The subjective element here is inescapable. The major problem of instructional simulation, however, is validity. As Steel (1965) points out, "In a strict sense we can never prove a simulation model valid, we can only build confidence in its validity on the basis of inductive inference" (p. 26). Complex computer-based simulations have the additional disadvantage of being expensive. But this can be overcome by widescale dissemination.

Instructional Simulation Programs

Simulation is a rather new technique in teacher training. In the early 1960's Kersh (1961) developed a classroom simulator where student teachers watch a simulated class on a large rear projection screen, film sequences and slides being presented to the trainee by a supervising teacher. The trainee reacted to a variety of classroom situations and the next film sequence was determined by his response and showed the consequences of his action. Although quite limited as a simulation, this program has produced encouraging results. Kersh (1965) found that his trainees were ready to assume full responsibility of student teaching up to three weeks earlier

than a control group having no such training. Vlcek (1966), using a replica of the simulator developed by Kersh, found that participation in the classroom simulation increased trainees' teaching confidence. Kersh's program has been followed with variations. Cruickshank (1966) describes a similar teacher training simulation with written incidents and role playing added to the film sequences. Rice (1966) includes in a similar simulation student records, report cards, teaching plans, and test data. Teacher training simulation has been shown to be highly motivating for the trainees, with at least the overall effectiveness of student teaching (Cruickshank & Broadbent, 1969).

Computer-based simulation has been used mostly with simulation gaming. Wing (1966) described two such games developed jointly by the Board of Cooperative Educational Services (BOCES) and International Business Machines (IBM). Both games, the Sierra Leone Development Project and the Sumerian Game, were designed to teach sixth graders some basic principles in economics. Compared to non-computer simualtions, computer-based simulation provides a more flexible learning environment. Whereas non-computer programs such as Kersh's require the presence of a supervising teacher, computer-based programs do not. The resultant privacy, the greater freedom in pace, and an uninhibited willingness for experimentation on the part of the trainees can add significantly to the learning experience. With a computer the variety and scope of learning materials can be greatly expanded. Indeed, this is the primary rationale for using the computer. Whithed (1970) explaines the computer need for a political simulation model:

> . . . we found it necessary to move to the use of computers in order to handle the mass of data inherent in anything more than a very simplistic effort at modeling the political environment within a reasonable time span and with a reasonable input effort (p. 7.36).

The use of the computer makes complex simulation models feasible.

Utilization of Computer Capabilities

CAI has opened a new dimension for instructional programs. Uttal et al (1969) divide CAI systems into three distinct categories: the degenerative, the selective, and the generative computer teaching machines. Degenerative computer teaching machines are "devices which are simply not using a sufficient amount of the computer's information processing capabilities really to be regarded as anything more than automated page turners or error tabulation devices" (p. 1). Linear programs would fall into this category. Most of today's instructional computer programs would fall into the second category of selective computer teaching machine systems. These, which include branching programs, likewise "represent a great underutilization of the computer's capabilities" (p. 3). They are too limited in their scope. Siklossy (1969) traces some of the limitations of selective programs to a fixed teaching network. All statements, questions and acceptable answers are prestored, as well as the flow of control which links them. The advent of generative computer systems lifted some of these limitations. Generative programs are capable of both generating and solving problems. They no longer show the rigid fixed structure of earlier degenerative and selective programs. Today computer-based education is no longer synonymous with "programmed" instruction. As Alpert and Ritzer (1970) point out, "Computer-based education makes possible unprogrammed instruction or student controlled learning by utilizing teaching strategies which differ completely from the basic tutorial logic of most programmed instruction" (p. 1584).

As more and more computer programs are developed, they tend to increase in size and complexity. Modular programming greatly facilitates the designing and programming of more complex instructional programs. Modular programming is based on the assumption that large complex systems tend to be hierarchical in structure, and are generally composed of interrelated modular or subsystems. Simon (1969) points out that "Hierarchic systems are usually composed of only a few different kinds of subsystems, in various combinations and arrangements" (p. 10). This functional

redundancy makes modular programming possible. Modular programs may be degenerative, selective or generative. They may show modular combinations of various types of programs. It is through modular programming that the construction of CAI programs invested with infinite complexity and versatility is made possible, that computer capabilities can be more fully realized. Modular programming and the generative computer capability offer a unique media for the simulation of complex systems. It is through simulation that computer capabilities can be more fully utilized in the educational field.

Overcoming the Problem of Dissemination

A major problem with computer programs has been dissemination. As Boocock (1967) points out, "The more innovative a new technique is the greater the difficulties of dissemination" (p. 94). For this reason, favorable prospects for dissemination are considered of basic importance to this project. A successful computer-assisted instruction (CAI) course in special education, CARE 1 (Computer Assisted Remedial Education), has been developed under the direction of G. Phillip Cartwright and Harold Mitzel (1971) at The Pennsylvania State University. The CARE 1 course has served approximately 1,100 persons in four states over a 16-month period (Cartwright, Cartwright, & Robine, 1972). Since CARE 1 does not include a simulation to allow practical experience, and since the computer is already introduced, it was felt that an outstanding opportunity existed for developing a complementary computer-based simulation unit.

CARE 1 is a CAI course in the early identification of handicapped children. The present simulation represents a first grade class from which the teacher-trainee gains realistic experience in the employment of acquired skills to identify exceptional children. The simulation draws heavily upon the generative capabilities of the computer, providing each teacher-trainee with a unique class setting, plus permitting numerous repetitions of the exercise, both for training and for teacher-trainee evaluation.

General Description of the CARE Simulation

CARE S (Computer-Assisted Remedial Education Simulation) is a simulated first grade class. It presents the trainee, projected as the teacher, with a realistic classroom situation. The trainee is introduced to each child in the class of 15, chosen at random from a larger pool and individually photographed on a filmstrip. As teacher, the trainee has the responsibility of identifying those children with impairments which threaten regular progress under the general school curriculum. To facilitate this, extensive information is made available. The trainee must decide what information is relevant, and select those data which will efficiently lead to the correct identification of any exceptional children. CARE 1 (Computer Assisted Remedial Education) provides a working procedure, as outlined in a decision process diagram (Figure 1). For maximal utilization, CARE S is closely structured on this decision process.

The trainee is first presented with a pool of general class information, from which he may select whatever he deems necessary for singling out individual children for further inspection. Having chosen a specific child for investigation, he continues to select information for this child until he decides whether the child shows deviations of such nature and severity to constitute a serious threat to regular educational progress. If the decision is affirmative, the trainee prepares a teacher referral statement, identifying the child's specific problem areas: input, information processing, output, health and/or behavioral problems (Appendix A). After referring the child, the trainee receives feedback in the form of relevant factual materials, e.g., psychological reports and medical reports. The computer provides guidance to the teacher-trainee in the event of an incorrect decision. The degree of assistance is determined by the amount of trainee effort spent in evaluating the child in question. After investigating a specific child and reaching a decision on that child, the trainee returns to the general class information section and the process is repeated until the trainee is satisfied that he has identified all of the exceptional children in his class.

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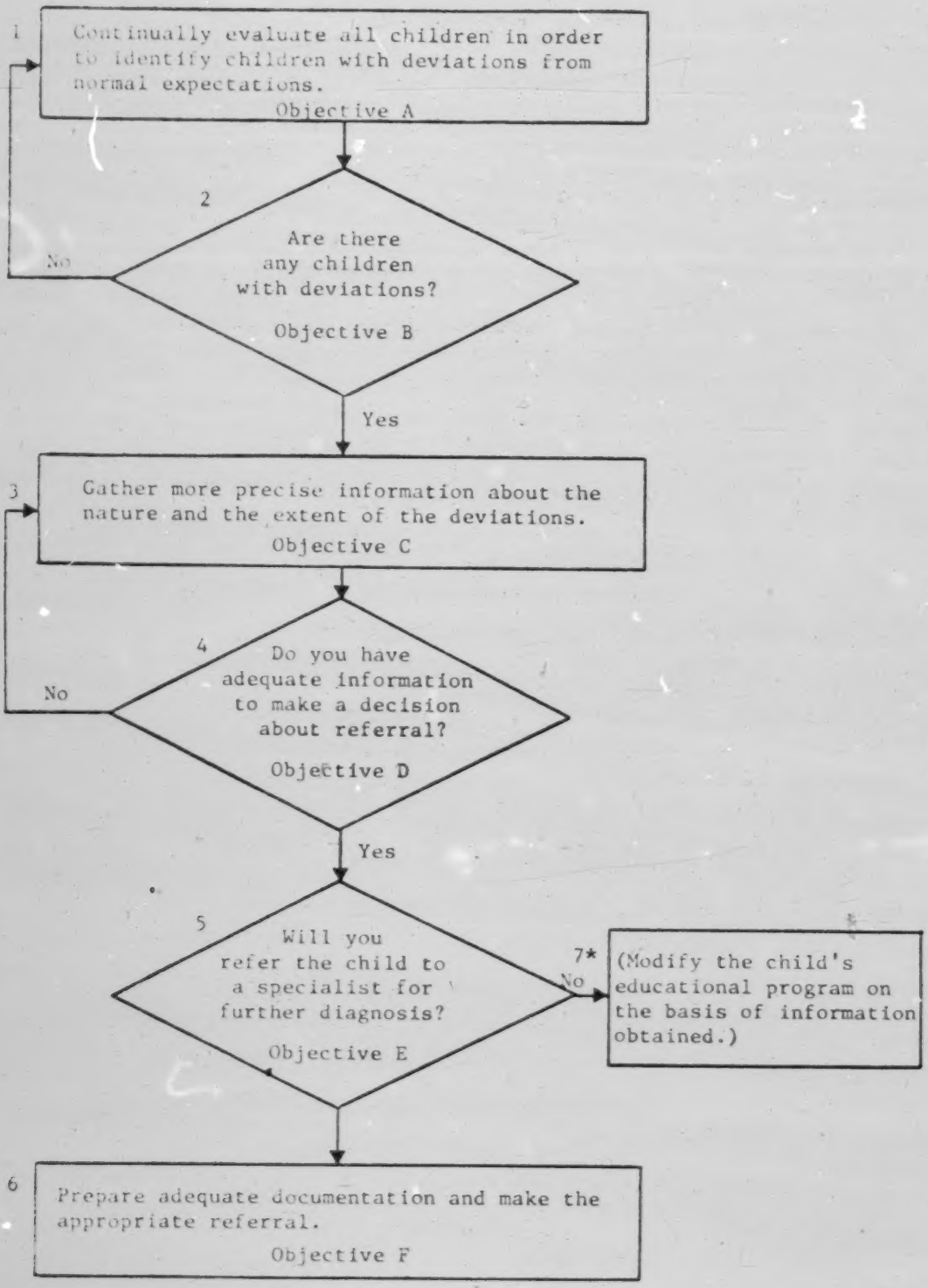

*This step is the subject of a CAI course to be developed.

Figure 1.--Decision Making Process
(Cartwright & Mitzel, 1971, p. 7)

formulate appropriate educational plans according to a decision-making process which is closely allied with the stated objectives.

Content Analysis of CARE S

CARE S provides the trainee upon his request with a variety of information modules containing data on all children in his hypothetical classroom. Information for both normal and exceptional children, representing various ethnic groups, is generated from large pools and presented to the trainee on the system's cathode-ray tube (CRT) display and the filmstrip projector. The content of the information modules follows closely the materials covered in the CARE 1 course and is partially based on the CARE 1 chapter "Case Histories" (Cartwright & Cartwright, 1970). The information modules are divided into two major sections: general class information to determine interindividual difference, and individual child information to obtain data about intra-individual differences. Figure 2 shows the basic inquiry components for general class information. The general class information serves as a basis for steps one and two of the decision process. Information of all children as a group is available to the trainee. The following general information modules are included in CARE S:

Kindergarten Records: Kindergarten records are available for only two-thirds (10) of the children since, as in a real classroom situation, some students have no formal preschool preparation. The records consist of a short teacher comment and a grade of satisfactory (S) or unsatisfactory (U) in the subjects of reading, numbers, art, and language for each child. Information is displayed for five children at a time.

ABC Readiness Test Scores: ABC Readiness Test scores and their percentile rating are available for all children simultaneously.

Sociograms: The data necessary for constructing sociograms, but not the sociograms themselves, are generated for the children. Each child states his choice(s) of playmate(s). The information is presented to the trainee in its basic form, thus requiring him to synthesize it as he would

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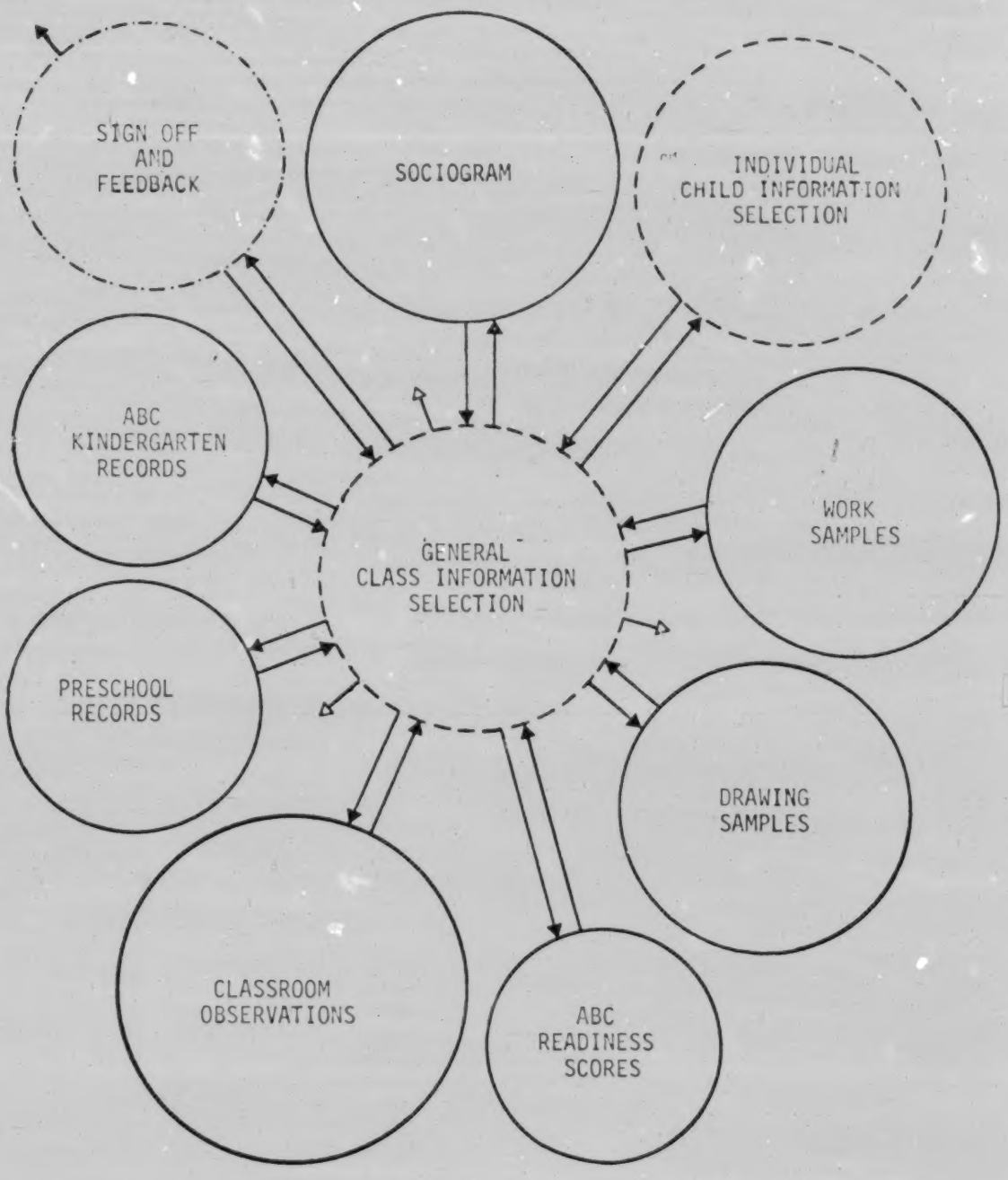

Figure 2.--Inquiry components for general class information

do in a real class setting. Each trainee request will result in a somewhat different sociogram.

Performance Samples: Actual work and drawing samples of the first grade students are available to the trainee. One sample of each student is shown at a time. Each trainee request will present to him a different display of performance samples, thus enabling him to examine several performance samples of each child.

Daily Observational Class Records: General observational comments are available for all children. Class observations are dated and only one to three observations are available at a time. The trainee, however, may continue to observe his class as long as he wishes by requesting additional observational comments. Comments for the exceptional children are generally more frequent than comments for the other children. This of itself might constitute a clue to the alert trainee. A greater frequency of comments on the exceptional children in a real classroom setting is probable. However, the clue effectiveness of a disproportionate comment representation is felt to be vitiated both by the relatively poor chance of an inordinate number of clues being generated for any one child and by the at times unrevealing nature of the clues.

The second major information section, the individual child information, serves as the basis for steps three through six of the decision process. Some of this information overlaps with the general class information. However, the emphasis is now on the individual child, or intra-individual differences. The content of the individual information modules included in CARE S is described below:

Biographical Data: Biographical data include the child's full name, his age up to the nearest month, the number of brothers and sisters and the child's own position in the family. Also included is information about his parents, their names, education, and occupation.

Health Data: Basic health information is available concerning physical defects, the child's vision and hearing, and any medication he might be taking regularly.

Comments: Comments about the child by parents and, for some children, by their preschool teacher, are made available. All comments are short. Many of them are made deliberately subjective to afford the trainee opportunities to differentiate between relevant and irrelevant information.

Observational Class Records: These are observations for the specific child only. Class observations are dated, and only one comment is displayed for each day. Comments are generated as long as requested by the trainee.

School Achievement: Achievement reports are generated at intervals of six weeks as the school year advances. Presented are grades and short teacher comments for the following subject matters: reading, numbers, writing, art, music, and language. Accumulative grades are available with the advance of the school year.

Performance Samples: Actual work and drawing samples of the individual child are displayed on the image projector. A short sample of the child's speech is available on the audio unit.

Group Tests: Sociograms, as described under the general class information, are included in this section. In addition, the trainee has an opportunity to evaluate the child's performance on the Metropolitan Readiness Test (MRT), and the First Grade Screening Test (FGST). Detailed scores and performance samples are presented for the individual child. Draw-A-Man samples are included as a separate information module.

Self Report: A self report, how the child feels toward himself, his teacher and school, is generated for the individual child and can be readministered by the trainee (a new one generated) as often as desired.

Individual Tests: Individual profiles and the Denver Developmental Screening Test (DDST) are available for a few children only.

Medical and Psychological Reports: For the purpose of providing feedback or guidance, detailed medical and psychological reports are available to the trainee, but only after a child ahs been referred to a specialist for further diagnosis.

Basic Structural Design of CARE S

The program structure of CARE S consists of a basic control program and the set of information modules just described. As its name suggests, the control program handles the general mechanics of the simulation. For each trainee it generates the class by randomly selecting 15 children from a large pool. Unknown to the trainee, the control program determines which children will be assigned disabilities. The three children are XXXX, a child with an undiagnosed hearing impairment; YYYY, a child with undiagnosed petit mal seizures which have become more pronounced during the last year, this child being of above average intelligence; and ZZZZ, a child with a diagnosed progressive visual impairment, and an additional behavioral problem. Random generation of the class assures each trainee a unique class sample and allows for repetition of the simulation exercise by the same trainee. The control program keeps a record of the children assigned to each simulation exercise.

The control program also operates a built-in calendar of a regular 180-day school year. This calendar automatically advances with information items requested by the trainee, simulating a realistic expenditure of time for securing these items. The time consumed in the identification of all the exceptional children in the class serves as one criterion for trainee efficiency. Another task of the control program is to keep a record of the trainee's inquiry path and his decisions. Three measures of trainee performance are obtained: (1) The trainee must decide which of the children manifest exceptionality of such nature and severity as to interfere with regular educational progress. As there are 15 children in all, the error range is from 0 to 15. (2) The trainee is expected to reach the necessary decisions with the least amount of unnecessary exploration. As the computer records the trainee's inquiry path, the total number of information pieces used, together with the above-mentioned calendar, will serve as an objective evaluation measure. (3) Having determined which of the children manifest significant exceptionalities, the

trainee is expected to further establish the specific areas of the problem, i.e., input, information processing, output, health, and/or behavioral.

The basic structure of CARE S allows for easy revision and expansion. Any number of information modules can be added. The present CARE S program allows for only three exceptional children, with only three exceptionalities. Ideally, the number of exceptionalities and the children bearing them could be expanded to allow random selection both of the types of exceptionalities and the number of exceptional children in a given class.

Computer Capabilities and Limitations

To be compatible with the CARE 1 (Computer Assisted Remedial Education) course the simulation is programmed in Coursewriter II for the IBM 1500 system. The way CARE S (Computer-Assisted Remedial Education Simulation) is designed and assembled is greatly determined by the limitations and capabilities of the system and the programming language.

Display Devices: The IBM 1500 provides a cathode-ray tube (CRT) for the visual display of alphameric, numeric characters, and dot matrix computer graphics. The CRT is limited to lighted display on a dark surface. No color display is possible on the IBM 1500 CRT. Additional visual information may be displayed on the 1512 image projector. The image projector has a 9 x 7 rear projection screen on which single black and white or colored film frames may be shown. No motion picture series are possible. One computer filmstrip contains 1,000 frames, of which all or part may be used. Access time to single frames is relatively fast, with a film speed of 40 frames per second. The IBM 1500 also is capable of providing audio displays. The 1506 audio tape unit provides up to two

hours of audio messages; however, the access time for the audio tape is rather slow, sometimes requiring several minutes of search time to locate a specific message. Due to this limitation, the audio tape unit is functional mainly for rather linear programming, when the recorded messages are played in near sequence. A 1518 typewriter terminal connected to the system provides printout materials. Student terminals, however, usually are not equipped with this typewriter.

Response Devices: The IBM 1500 system provides two response devices for the student: a light pen and an electronic typewriter keyboard. With the light pen the student points to specified areas on the CRT; the computer senses the beam and records the response. For natural language responses the keyboard generally is used. This mode permits a useful monitoring and correction of responses. The typed response appears on the CRT and the student may correct or change the response before entering it into the system.

Programming Language: Coursewriter II is primarily an author-language for building and administering instructional sequences (Frye, 1969). Its computational capabilities are limited. The language was not developed for generative programming and more sophisticated random selection. Programming of CARE S was thus unusually difficult.

Interface Requirements of CARE S

Glaser et al (1964) have shown how the subject matter should ideally dictate the design of terminal devices. However, it should be obvious that in practice a program will have to work with the media available. The specifications of the media will necessarily prescribe

the parameters and, to a lesser extent, the nature of the presentation. As the purpose of CARE S is to provide a realistic classroom situation in which the trainee gathers, analyzes and synthesizes information for the purpose of identifying exceptional children, the primary requirement of presentation is the maintenance of a realistic situation. It is thus desirable that each individual information topic be presented as realistically as the interface will permit.

The First Grade: To allow for repetition of the exercise and to prevent carryover of critical information from trainee to trainee, each teacher-trainee is assigned a different group of 15 children. To allow for maximum variation in class assignments, children are introduced individually on colored photographs on the image projector. The children are randomly selected from a pool of 12 boys and 12 girls representing various ethnic groups. To facilitate random assignment of names to textual displays, all children have four-letter names. None of the children's photographs show any obvious disability, thus allowing for random assignment of hidden disabilities to any three of the 15 children selected for each class group. Although the photographs of the children convey no information on educational probabilities, the presentation of them is felt to be justified by the demands of a maximally realistic situation. The trainee, being thus enabled to associate the names with faces, should realize a fuller, more immediate experience of working with real children. As in a real classroom setting, the teacher-trainee is afforded visual access to the children.

Achievement Reports: Kindergarten records and school achievement reports are displayed on the CRT. Kindergarten records are available for

several children collectively, while the school achievement report is displayed for each child individually. Figures 3 and 4 show sample CRT displays. These materials, in the form of grades and comments, are generated from pools for normal or individual exceptional children as applicable.

Readiness Tests: The simulation makes available to the trainee children's performances on three readiness tests: the ABC readiness Test, the Metropolitan Readiness Test (MRT), and the First Grade Screening Test (FGST). The ABC Readiness Test scores are presented for all children simultaneously to allow the student to look for interindividual differences. Scores for the various children are randomly selected from pools of possible scores for normal and exceptional children. Figure 5 shows a sample CRT display.

The MRT and FGST performances are presented for each child separately. To allow the trainee to look for intra-individual differences, more detailed information, including a performance sample are displayed on the CRT (Figure 6). A performance sample from the copying test is shown simultaneously on the image projector. Test scores for the FGST are presented together with one or two performance samples on the image projector. Samples are randomly selected from pools for normal and exceptional children, respectively.

Performance Samples: Children's work and drawing samples are presented in color on the image projector. Again, samples are drawn at random from large pools. Available are 144 performance samples for normal and exceptional children. Samples are identified on the CRT. The trainee may elect to see one sample from each child or several samples from one

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ABC KINDERGARTEN RECORD

NAME	READING	NUMBERS	ARTS	LANGUAGE
DORA	S	S	S	S
ELSA	S	S	S	S
JANE	U	S-	S	S
MARK	S-	S	S	S
MIKE	S	S	S	S

DORA IS SHY ESPECIALLY IN GROUP PLAY
ELSA THROWS TEMPER FITS ON OCCASIONS
JANE HAS TROUBLE FOLLOWING DIRECTIONS
MARK IS A HARD WORKER
MIKE IS A QUIET HARD-WORKING STUDENT

Sp

CEDAR VALLEY PRESCHOOL RECORD

NAME	READING	NUMBERS	ARTS	LANGUAGE
BILL	S	S-	S	S-
FRED	S-	S-	S	S
JUAN	S	S	S	S
MARY	S-	U	S-	S-
OLGA	S	S	S	S

BILL FIGHTS WITH OTHERS AT TIMES
FRED LIKES TO WORK WITH PUZZLES
JUAN LOVES TO PARTICIPATE IN PLAYS
MARY DOES NOT PAY ATTENTION AT TIMES
OLGA LIKES ANIMALS VERY MUCH

Sp

Figure 3.--Sample CRT Displays.
Note: In this sample child Y is Mary.

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ACADEMIC REPORT

GRADE: 1 NAME: JANE 10-14

SUBJECT	GRADE	COMMENTS
READING	S-	HAS TROUBLE SOUNDING OUT NEW WORDS
NUMBERS	S	USES CONCEPTS SUCH AS "MORE THAN" AND "LESS THAN"
WRITING	S	KNOWS ALL LETTERS

Sp

ACADEMIC REPORT CONTINUED

GRADE: 1 NAME: JANE 10-14

SUBJECT	GRADE	COMMENTS
ART	S-	TENDS TO BE SOMEWHAT MESSY
MUSIC	S	PARTICIPATES IN ALL MUSIC ACTIVITIES
LANGUAGE	S	LIKES TO RECITE AND TELL STORIES

Sp

Figure 4.--Sample CRT Displays.
Note: Image projector shows Jane's picture.

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ABC READINESS TEST SCORES SEPTEMBER 1

NAME	RAW SCORE	PER-CENTILE	NAME	RAW SCORE	PER-CENTILE
ANNE	52	50	JANE	58	75
BILL	36	18	JUAN	50	42
DORA	55	60	LUIZ	63	91
ELSA	54	57	MARK	40	21
FRED	61	86	MARY	53	55
GREG	59	79	MIKE	54	57
IRIS	49	40	OLGA	57	70
JACK	51	45			

Sp

Figure 5.--Sample CRT Display.

HERE ARE JANE'S TEST SCORES ON THE METROPOLITAN READINESS TESTS. A SAMPLE PERFORMANCE IS SHOWN ON THE IMAGE PROJECTOR

1. WORD MEANING	7
2. LISTENING	11
3. MATCHING	11
4. ALPHABET	15
5. NUMBERS	24
6. COPYING	13
TOTAL SCORE	81
PERCENTILE RANK	96
LETTER RATING	A

Sp

Figure 6.--Sample CRT Display.

child only. Speech samples are more limited. To keep the audio search time to a minimum, only one short speech sample for each child is available on the audio unit.

Sociograms: Sociograms are generated by the computer and presented to the teacher-trainee unassembled. Each child states his choice of play- or workmates on the CRT (Figure 7). While a child states his choice, his picture is shown simultaneously on the image projector. As in a real life situation the teacher-trainee needs to compile his own sociogram.

Observational Comments: Since the IBM 1500 has no provision for motion picture sequences, it is not possible to provide the trainee with an opportunity to observe his class and to record his own observations. Thus the trainee is provided with the observational comments already prepared. Comments again are available for all children as a group or for one child at a time. Figure 8 shows a sample CRT display. Other comments available are statements by parent or guardian, and the opinion of the pre-school teacher. All comments are randomly selected from pools. Children's names are randomly substituted in a precoded space in the comment allowing for a large variation.

Personal Data: Biographical and health data for the individual child is presented on the CRT in the form of completed short questionnaires (Figures 9 and 10). The child's picture is simultaneously shown on the image projector. Information for the questionnaire is again selected at random from various information pools.

Individual Tests: In addition to the readiness tests, additional materials are made available for some children. Individual profiles

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Figure 7.--Sample CRT Display.
Sociogram

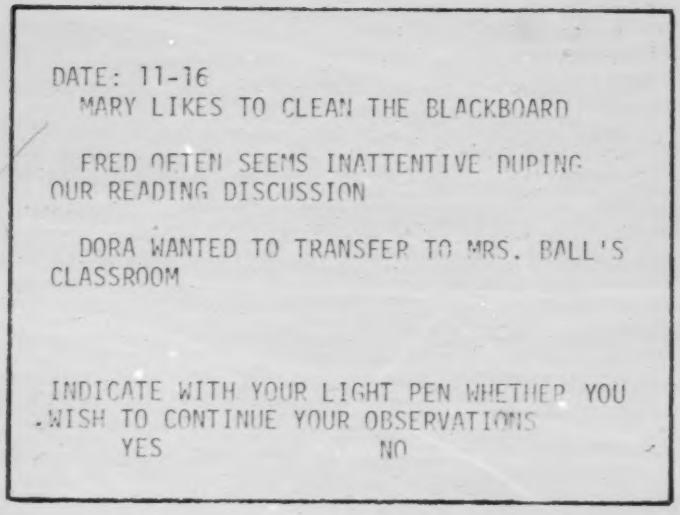
DATE: 11-16
MARY LIKES TO CLEAN THE BLACKBOARD
FRED OFTEN SEEMS INATTENTIVE DURING OUR READING DISCUSSION
DORA WANTED TO TRANSFER TO MRS. BALL'S CLASSROOM
INDICATE WITH YOUR LIGHT PEN WHETHER YOU WISH TO CONTINUE YOUR OBSERVATIONS
YES
NO

Figure 8.--Sample CRT Display.
Observational Comments

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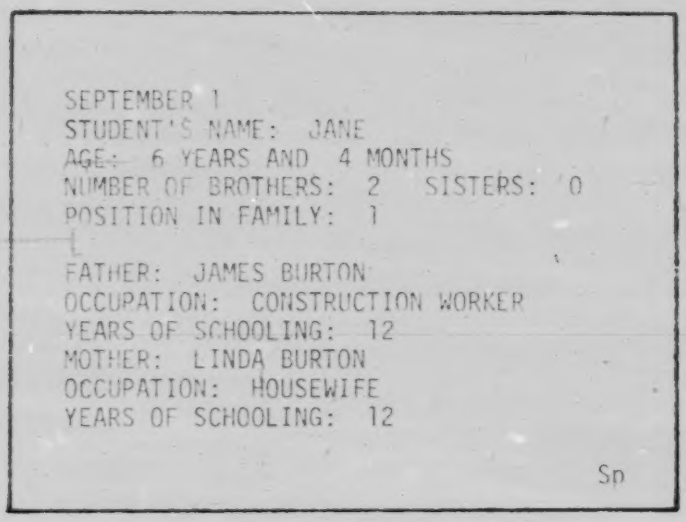

Figure 9.--Sample CRT Display.
Biographical Data

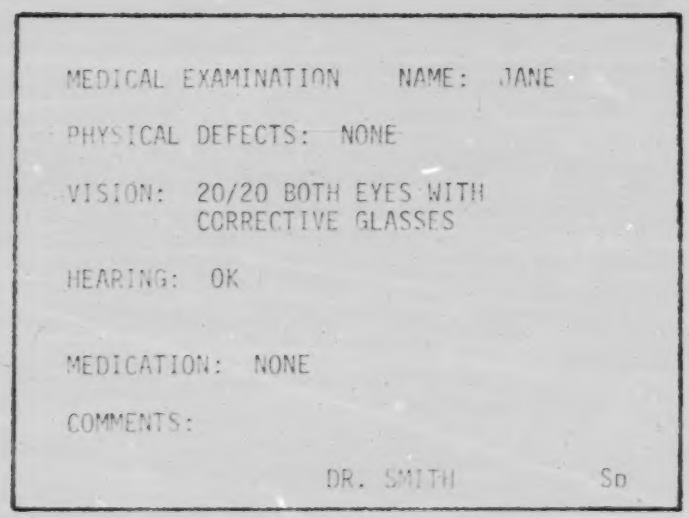

Figure 10.--Sample CRT Display.
Medical Data

(Figure 11) and the DDST are presented to the trainee on the image projector. Results on special medical and psychological tests are reported on the CRT, and supplementary material is shown simultaneously on the image projector as shown in Figures 12 and 13.

Self Report: The self report consists of twelve questions administered on line by the trainee to one pupil at a time. The pupil's answers are generated within set parameters and displayed on the CRT. Figure 14 shows a sample display.

Learner Control

With the exception of the short introductory sequence and the decision and feedback loop, all information displays are under direct learner control. From a list of information topics trainees select which one they would like to see. After the information is displayed the student is again returned to the selection frame. Figure 15 shows the student control options and the flow of the simulation program.

The trainee begins with the general class information selection frame (SELECT 1). From here he may proceed to any of the 15 individual child selection frames (SELECT 3). Once he has completed his evaluation of a specific child, he enters the decision and feedback loop and returns to SELECT 1. The trainee may evaluate as many of the children as he feels is necessary to reach the objective of CARE S. At a minimum, evaluation of the three exceptional children is required. Once an individual child is evaluated and a decision reached, only general class information will be available further for that particular child.

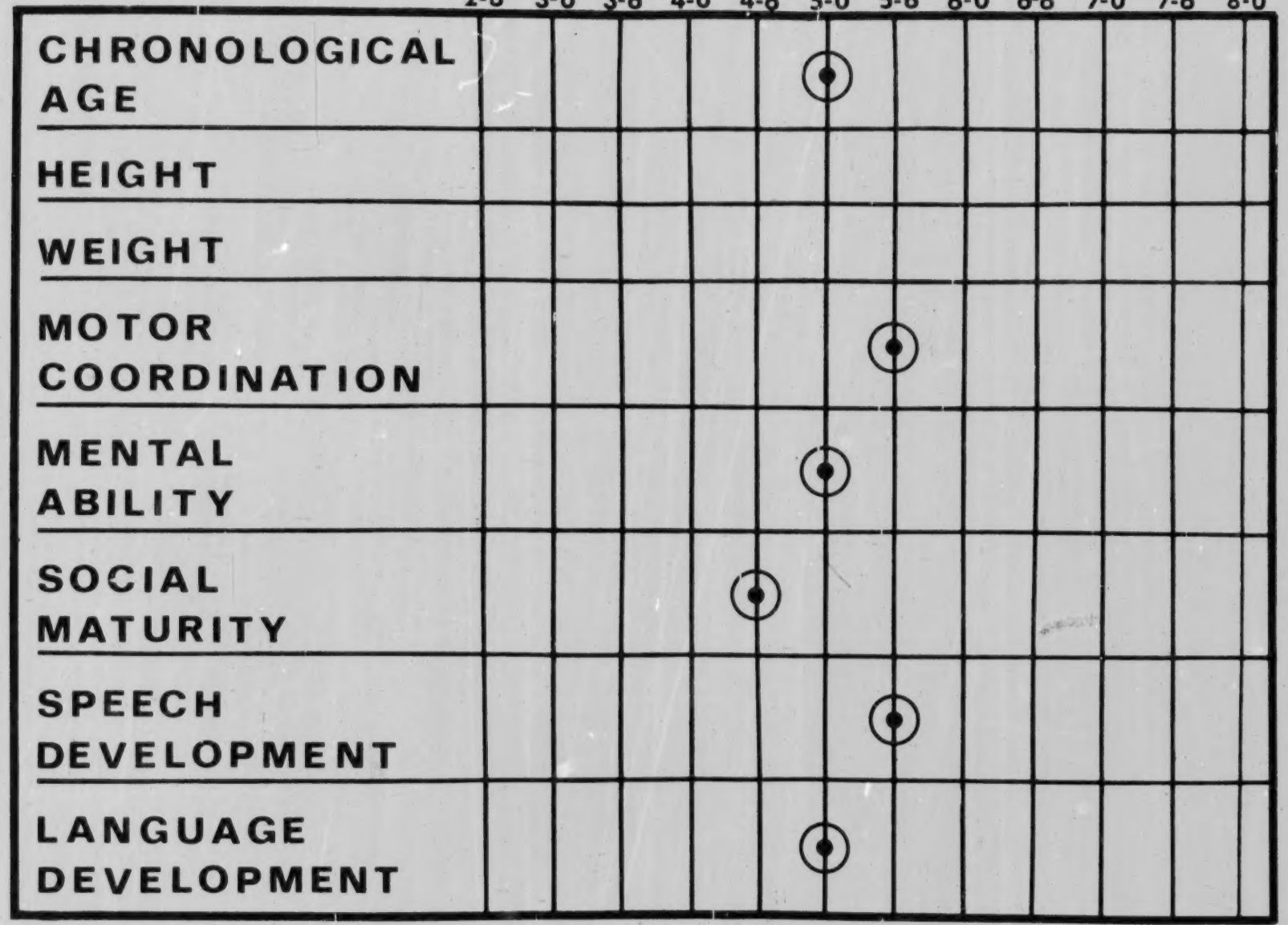

Figure 11.--Individual Profile

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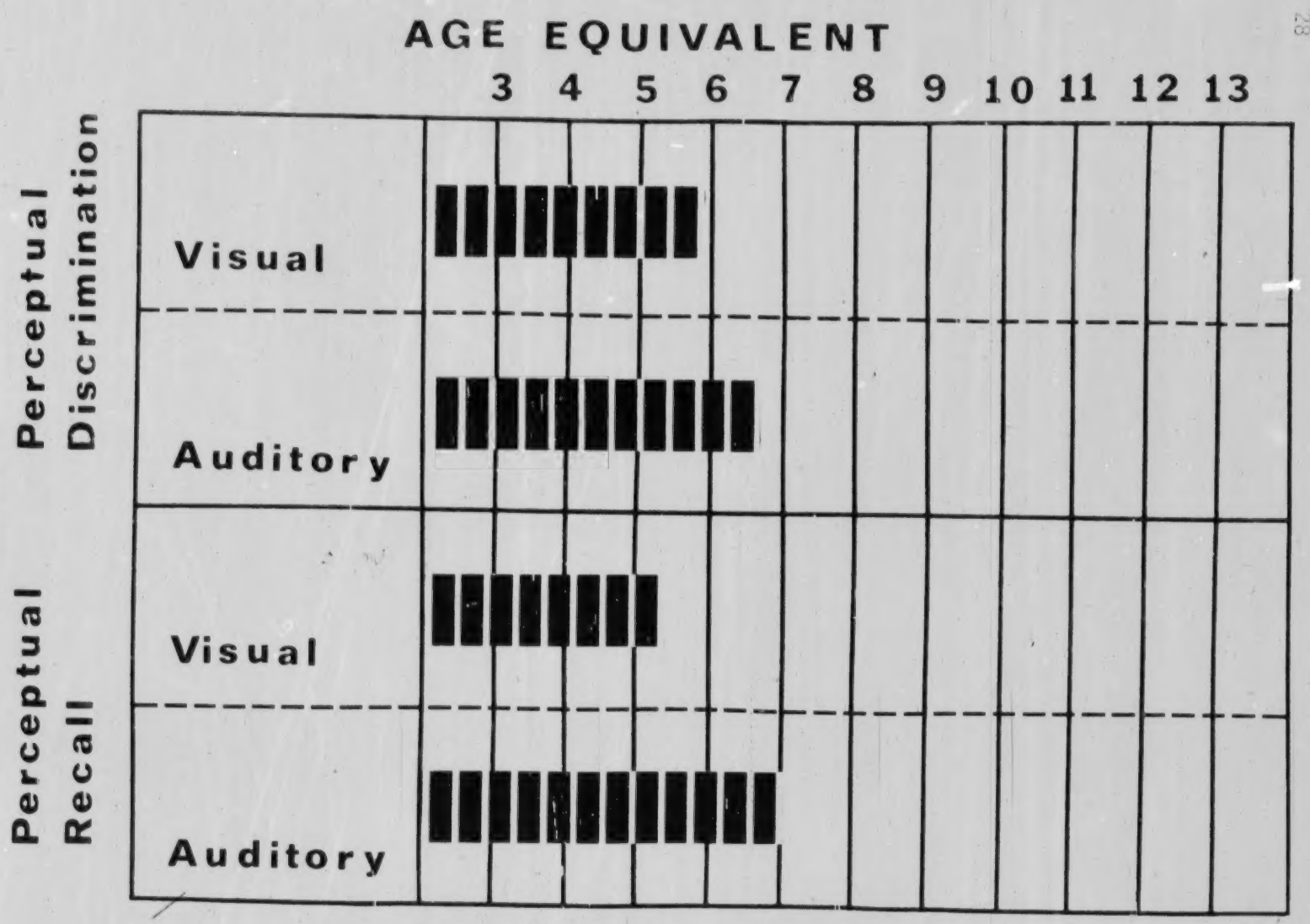

Figure 12.--Auditory and Visual Task Performance Chart

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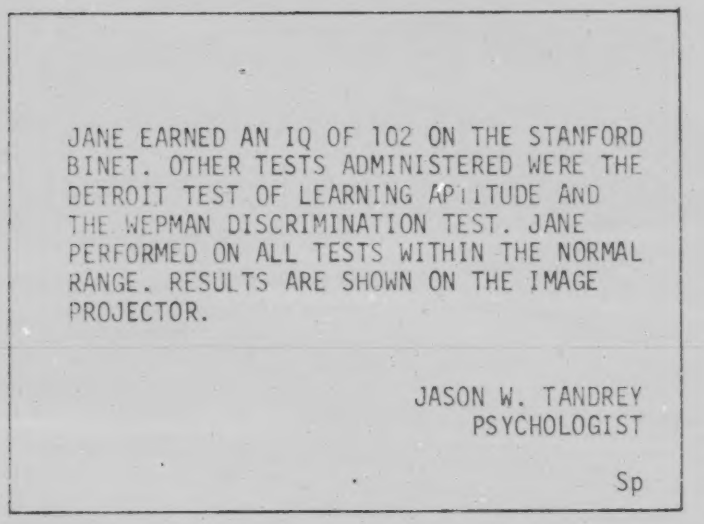
JANE EARNED AN IQ OF 102 ON THE STANFORD BINET. OTHER TESTS ADMINISTERED WERE THE DETROIT TEST OF LEARNING APTITUDE AND THE WEPMAN DISCRIMINATION TEST. JANE PERFORMED ON ALL TESTS WITHIN THE NORMAL RANGE. RESULTS ARE SHOWN ON THE IMAGE PROJECTOR.
JASON W. TANDREY
PSYCHOLOGIST
Sp

Figure 13.--Sample CRT Display.
Psychologist's Report

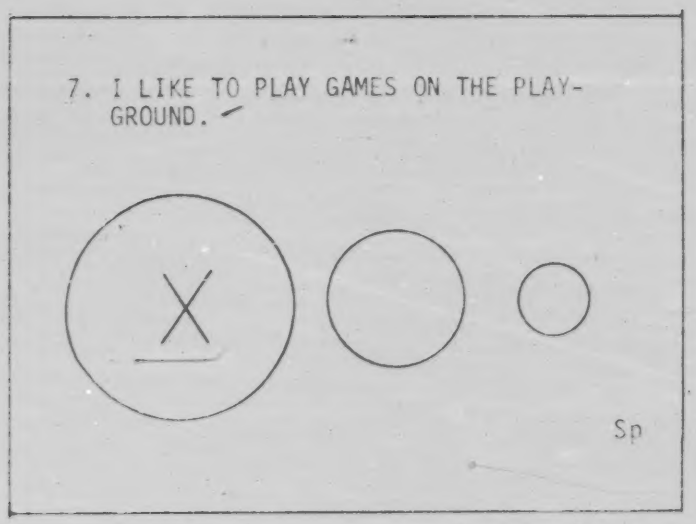

Figure 14.--Sample CRT Display.
Self Report

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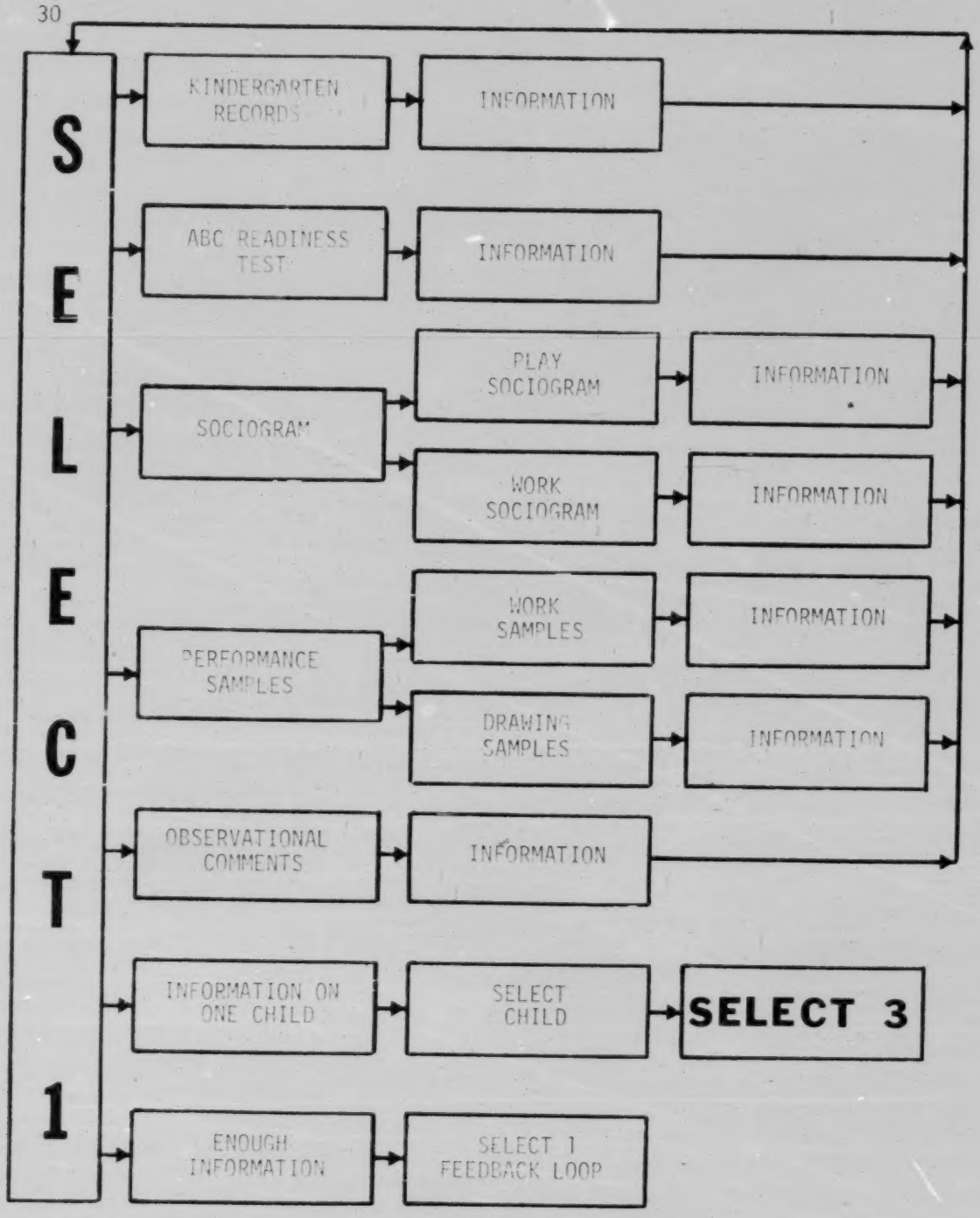

Figure 15a.--Student control option.
SELECT 1

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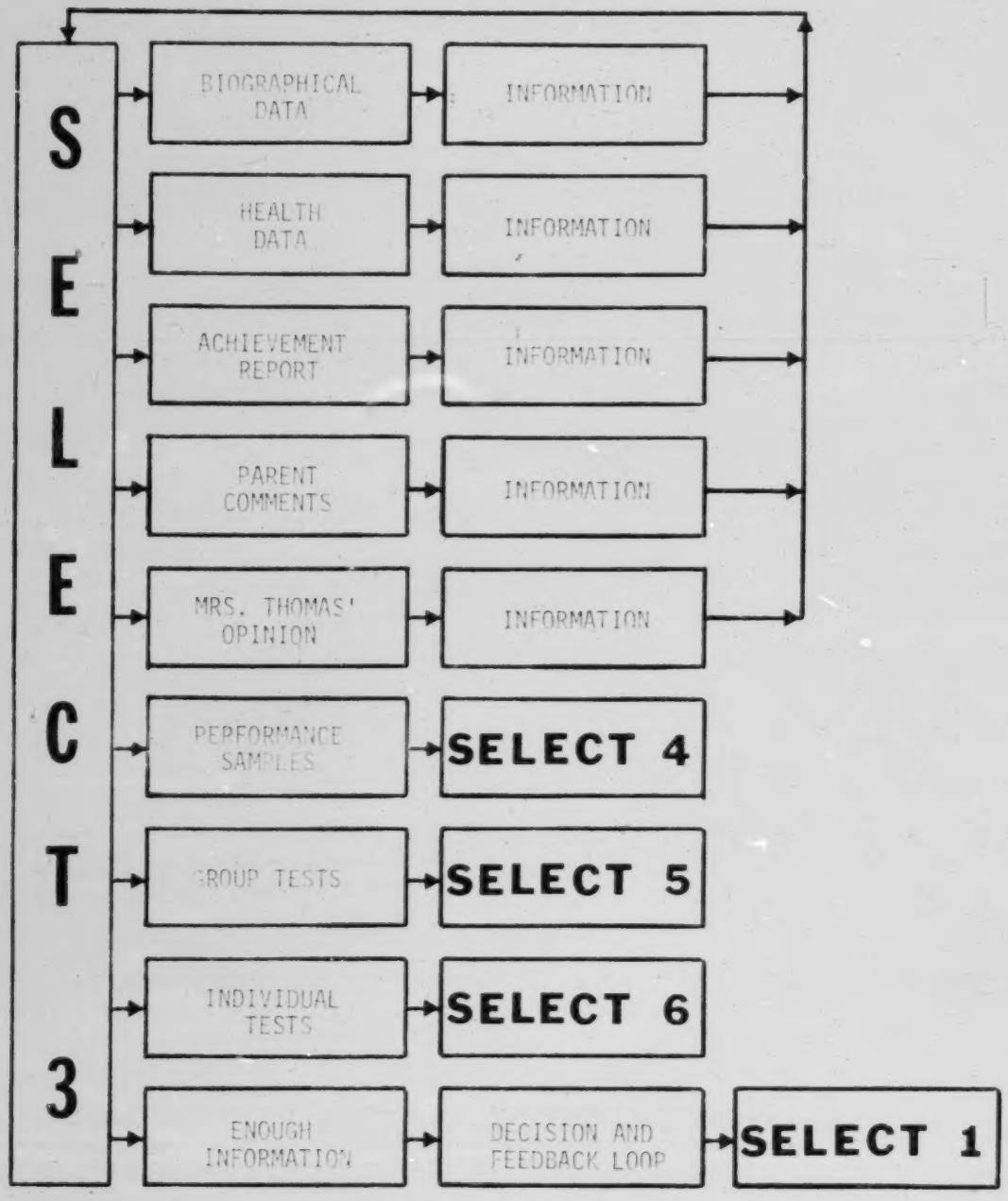

Figure 15b.--Student control option.
SELECT 3

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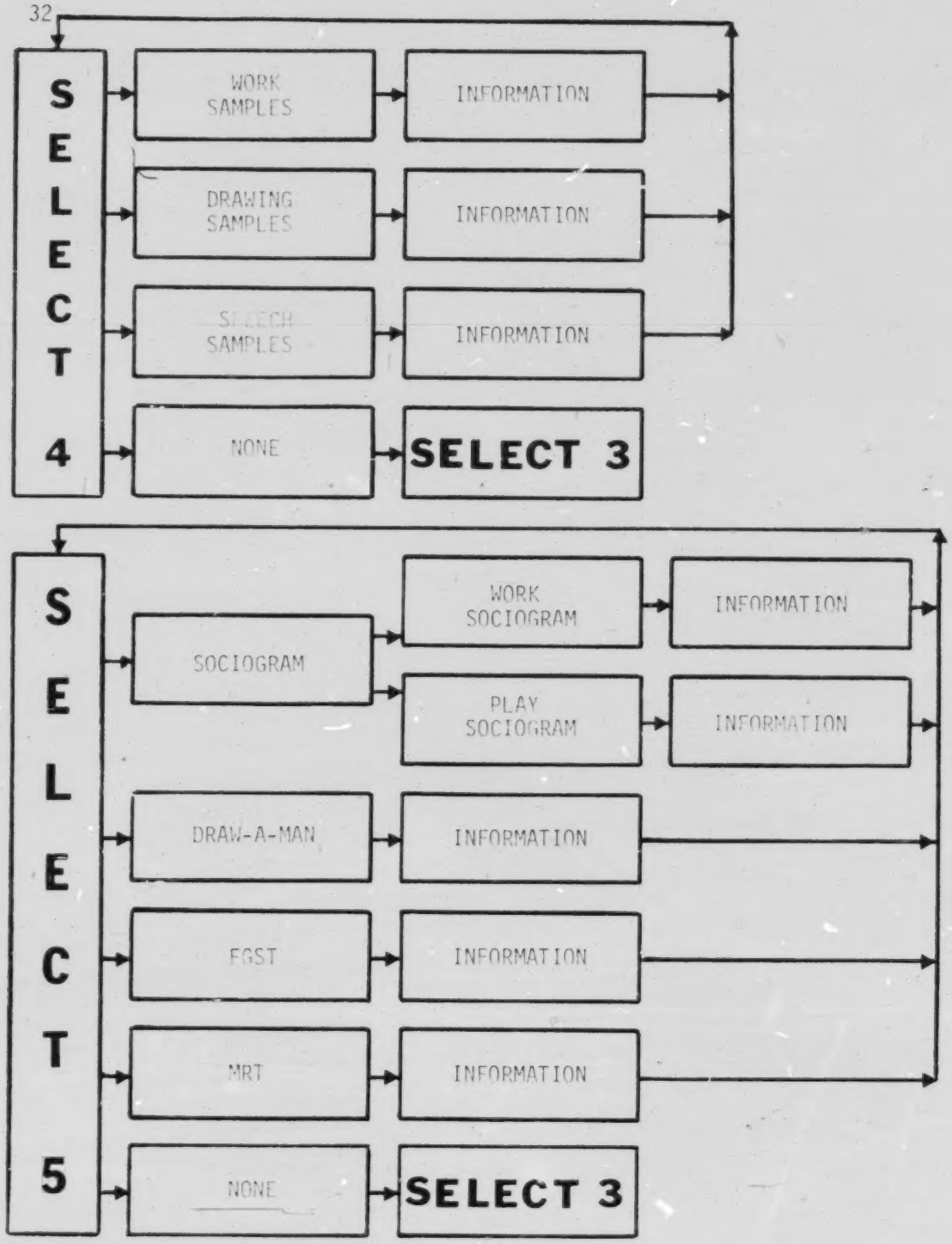

Figure 15c.--Student control option. SELECT 4 and 5

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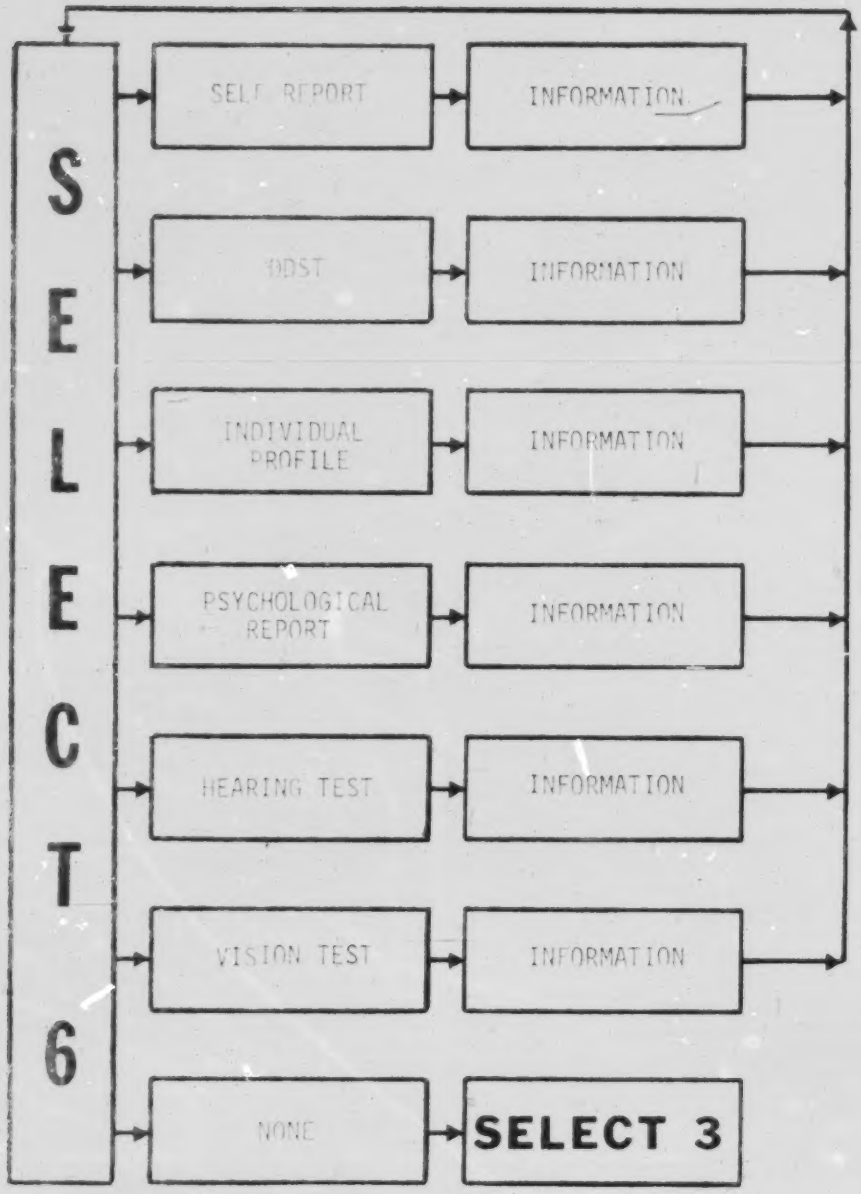

Figure 15d.--Student control option. SELECT 6

Decision and Feedback Loop

When the trainee has collected what he believes to be enough information for any particular child or for all children as a group, he enters a decision and feedback loop. This is the only part of the program where branching is mostly under computer control. Figure 16 shows the general flow of the decision and feedback loops. In the SELECT 3 decision loop the student is asked to make a decision on the child he has evaluated. Does the child need to be referred to a specialist? If the decision is incorrect the trainee will receive assistance and the opportunity to gather additional information from the computer. If the decision is correct the trainee will receive feedback and is branched to the general class information selection.

The SELECT 1 decision loop examines the trainee's performance record. Should the trainee have failed to identify any of the exceptional students, he is provided assistance and given another chance to gather additional data. When the trainee has successfully identified all exceptional children he receives feedback and is signed off.

Programming and Coding

CARE S is programmed in Coursewriter II (CW), a computer language developed specifically for instructional question and answer sequences. Because CW has limited randomization and computational capabilities, programming of CARE S presented some elemental problems. Special functions had to be developed to facilitate programming of generative processes.

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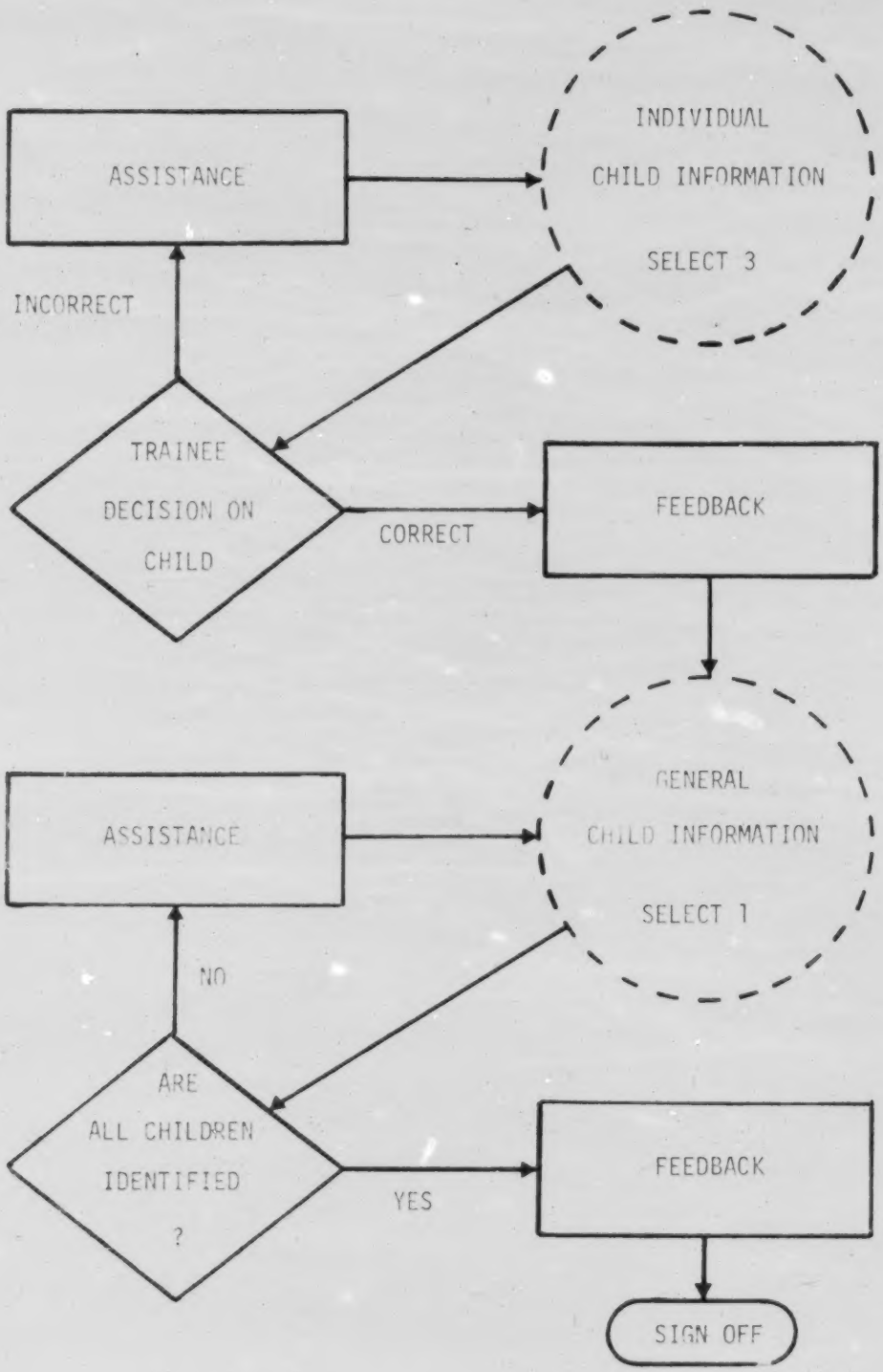

Figure 16.--Decision and Feedback Loops.

Coding of Data Pools

The CARE S program generates the information for most of the modules from large data pools analogous to FORTRAN arrays. CW, however, has no memory for storing data. Data pools are therefore coded as part of the program in the form of non-executable instructions. Each entry can be located by reference to the label of the pool and its individual sequence number. An example is the data pool of the CARE S 180-day school calendar (Table 1). Under the label DATETB are 180 no-op instructions with the date corresponding to the nth day of the school year. One counter (C30) is reserved for the calendar, which is advanced at various points in the program. When the program requires the calendar date, the day of the year is loaded into a buffer by using DATETB + C30 as reference and is then displayed on the CRT; e.g., if C30 = 4, the date displayed would be 09-08. The other data pools are treated similarly.

Generated Data Structures

The program differentiates between three types of generated data: primary data consisting of class membership and children's attributes; secondary data based on the primary data, e. g., information data, comments, etc.; and program control data based on trainee performance which includes all data not "seen" by the trainee.

Primary Data: Figure 17 shows an example of the primary data structure. Each of the 24 children in the data pool corresponds with one of the 24 switches. The 15 children included in the simulation are flagged for future reference by setting the corresponding switch to 1. The attributes of the selected children are then stored in counters 1 through 8.

Table 1

THE SCHOOL CALENDAR DATA POOL

```
DATETB*E
$$  1 NØ  09-02*E
$$  2 NØ  09-03*E
$$  3 NØ  09-04*E
$$  4 NØ  09-08*E
      .
      .
      .
$$180 NØ 05-28*E
```

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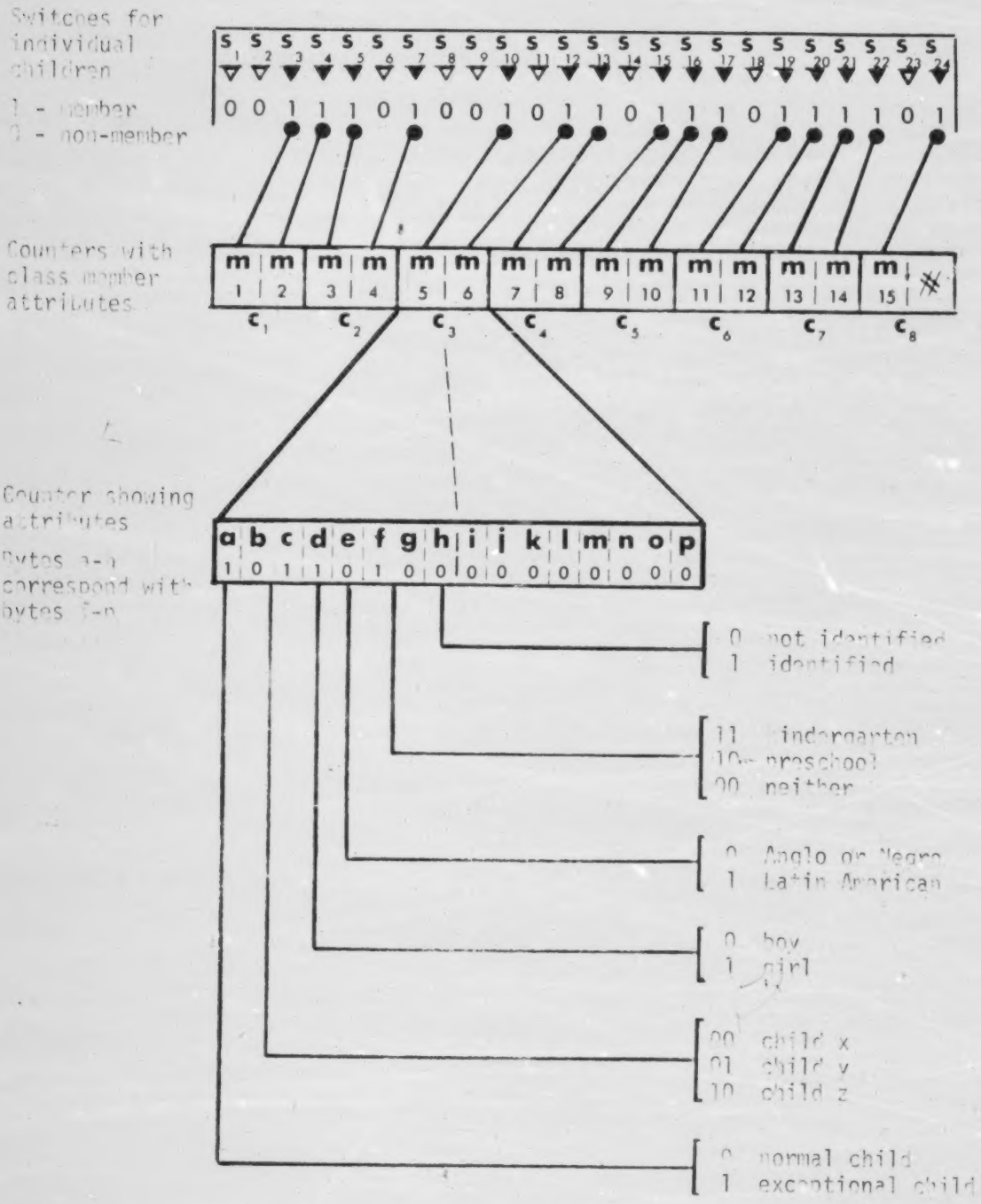
Switches for individual children
1 - member
0 - non-member
S S S S S S S S S S S S S S S S S S S S S S S S
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
0 0 1 1 1 0 1 0 0 1 0 1 1 0 1 1 1 0 1 1 1 1 0 1
Counters with class member attributes
m m | m m | m m | m m | m m | m m | m m | m
1 2 | 3 4 | 5 6 | 7 8 | 9 10 | 11 12 | 13 14 | 15
c1 c2 c3 c4 c5 c6 c7 c8
Counter showing attributes
Bytes a-p correspond with bytes 1-n
a b c d e f g h i j k l m n o p
1 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0
0 not identified
1 identified
11 kindergarten
10 preschool
00 neither
0 Anglo or Negro
1 Latin American
0 boy
1 girl
00 child x
01 child y
10 child z
0 normal child
1 exceptional child

Figure 17.--Example of primary data structure.

The sex and ethnic background are fixed for each child. The program uses the position of the child's name in the name data pool to determine the appropriate setting of the switches, d and e, and l and n, of counters 1 through 8. The other class members' attributes are name-independent and randomly assigned. This method of storing class member attributes was selected because of the CW limitations. A special function TSTSW was developed to test switches 1 through 24 and to store and retrieve information from counters 1 through 8 simultaneously.

Secondary data: The information data generated by the various modules falls into two categories: temporary data, which is generated for each trainee request, e.g. comments, sociograms, etc.; and permanent data, which is generated once, the same being displayed for each additional trainee request, e.g., biographical data, school records, etc. Again, the permanent data presented a storage problem. A small quantity of data was stored in counters or quasi-counters. Most of the permanent data, however, was stored as no-op instructions similar to the data pool storage described earlier.

Program Control Data: This data consists of the trainee's trace chain (examples are shown in Appendix B), pointers for the trace chain, pointers to no-op storage, the number of requests for specific information items, the school calendar, and the quasi-counter restart storage.

Function TSTSW

Function TSTSW was written to perform the following operations:

1. Test a switch S_1-S_{24} to determine whether a particular child is a class member and, if so, to retrieve and transfer the child's attributes into a specified counter, left-justified.
2. To store (or reset) a child's attribute switches after some program modification.

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In many of the modules of CARE S, it was necessary to locate a child conforming to specific criteria, e. g., a boy with an Anglo surname who attended kindergarten. The method, depending upon the particular module, usually consisted of either cycling through the entire class range 1-24 (until the right match was made) or generating random numbers 1-24 until a suitable match was made. Since TSTSW retrieves the attributes each time a switch is positive, the number of instructions necessary to make the final match is greatly reduced.

Calling sequence:

1. Test Switch

TSTSW"/C_i"/C_j"/C_k≠

- C_k will contain the attributes left-justified if C_j = 0.
- C_j: If switch is off, then C_j = 0. If switch is on, then C_j = the byte #1-15 of the corresponding attributes.
- C_i: Counter containing the number 1-24 of the switch to be tested.

2. Store

TSTSW"/S"/C_j"/C_k≠

- C_k: Counter which contains the byte to be stored. The left byte of C_k is stored.
- C_j: The byte #1-15 in which to store. (Bytes are in C_1-C_8.)
- S: Literal S indicating store function.

It can be observed that when attributes are transferred into a counter C_k by call (1) they can be modified by loading into S_ka, S_kb, ...

S_kh and then restored by changing parameter (1) to S C_i will still be pointing to the correct byte of C_1-C_8.

No-Op Storage Data

Data stored into CW no-op instructions was accomplished by using function PSREMV. In some instances data stored is display data from buffers; in others, it is numeric data from counters. In either case, no conversion of the data is required for storage or retrieval. A listing of the course will produce some apparent "garbage" for those tables which have numeric data stored in them since all the numbers there do not have corresponding printer codes.

The storage tables are assembled from cards with blank text for the comment portion of the instructions. The length of the instructions varies depending on the amount of data to be stored there. Reading or writing begins at word 4 of the instruction (word 5, counting from 1) and must end before the final EOB (End of Block) of the preassembled instruction.

A list of these tables, their use and formats is included in Appendix C.

Conclusion and Projection

The growing need for more effective programs in special education combined with the unique opportunity offered by the CARE 1 course suggested the feasibility of CARE S, the computer simulation program herein described. Key considerations were the potential of simulation as a tool for instruction and evaluation, and the unique capacity of the computer for handling the diverse materials of complex systems. CARE S is a simulated first grade

class. The trainee is projected as the teacher and is charged with the task of screening the pupils to identify those children with significant educational problems. To facilitate this the program provides an array of informative materials normally at the disposal of the teacher. The collection of these materials, and the subsequent preparation of them to meet interface requirements, was directed by the primary concern of preserving fidelity. For the simulation as a whole the primary concern was to evoke the presence of a real classroom situation.

As a program for identifying the exceptional child, CARE S marks a mere beginning. The concept of instructional computer simulation has far-reaching implications for special education. As the CARE sequence develops, CARE S can be broadened accordingly to provide a realistic setting for the teacher-trainee to practice skills acquired in other CARE courses, e.g., remedial education. The modular construction of CARE S permits infinite variation and can accommodate various objectives. This flexibility offered in the modular design is especially compatible with the broadened scope of educational programs which simulation makes possible.

APPENDIX A

TEACHER REFERRAL STATEMENT

Teacher Referral Statement

Name of Child: _____ Date of Report: _____

Birth Date: _____ Sex: _____

Teacher: _____ Grade: _____

I. Achievement Data

Describe the child's typical performance in each area. Use behavioral terms so that the description is precise. Attach samples of the child's work where applicable. Cite any available test results.

A. Oral Language _____

_____

Written Language _____

_____

B. Reading Comprehension _____

_____

Word Analysis Skills _____

_____

C. Mathematical Comprehension _____

_____

Computation Abilities _____

_____

D. Music _____

_____

Art _____

_____

Dramatic Play _____

_____

E. Other _____

_____

Name of Child: _____

II. Learning Behaviors Check List

Place a check mark next to the statements which describe behavior usually exhibited by the child. Use the comment space to elaborate on your choices and to provide supporting information.

A. Behavior Related to Inputs

_____ is attentive during most activities

_____ is attentive only during his favorite activities

_____ rarely pays attention

_____ indicates a preference for material received through the auditory channel

_____ indicates a preference for material received through the visual channel

_____ does not indicate a preference for one input channel over another

_____ performs better when information is received through the auditory channel

_____ performs better when information is received through the visual channel

_____ performs better when he receives information through a combination of visual and auditory channels

_____ is able to use tactile sensations

_____ exhibits unusual behavior during activities which require good hearing

_____ exhibits unusual behavior during activities which require good vision

Comment: _____

_____

_____

_____

Name of Child: _____

B. Behaviors Related to Information Processing

_____ organizes tasks and materials so that time is used efficiently

_____ has short-term retention for most learning areas

_____ has long-term retention for most learning areas

_____ can recall information for only some selected learning areas

_____ does not remember information

_____ discriminates between sounds

_____ discriminates between shapes and figures

_____ discriminates between letters, numbers, words

_____ can make associations

_____ can recognize associations

_____ can make generalizations

_____ can differentiate between generalizations and specific facts

_____ translates from concrete experiences to abstractions

_____ is able to profit from incidental learning

_____ finishes (or attempts to finish) tasks he starts

_____ completes only those tasks he enjoys

_____ is easily distracted regardless of task

_____ follows instructions directed to a group

_____ follows instructions directed to him individually

_____ follows one direction but not a sequence of directions

Comment: _____

_____

_____

Name of Child: _____

C. Behaviors Related to Outputs

_____ volunteers comments, answers, etc. during group activities

_____ speaks spontaneously on a one-to-one basis to other child and/or adults

_____ speaks only when called on or when conversation is initiated by another person

_____ must be urged to speak

_____ shows specific speech problem (describe)

_____ performs gross motor skills in coordinated fashion

_____ performs fine motor skills in coordinated fashion

_____ is clumsy and awkward in most motor activities

_____ exhibits involuntary repetition when making a motor response

_____ exhibits involuntary repetition when making a spoken response

_____ uses a vocabulary typical of older children

_____ uses a vocabulary typical of children his age

_____ uses a limited vocabulary

_____ uses compound and complex sentences

_____ uses only simple sentences

_____ uses single words and some phrases, but not complete sentences

_____ reverses some letters and/or numbers when writing

_____ prefers right hand for most activities

_____ prefers left hand for most activities

_____ uses either hand with about equal dexterity

Comment: _____

_____

_____

Name of Child: _____

D. Behaviors Related to Feedback

(Place a check mark next to the events which are rewarding for the child)

_____ consumable rewards such as candy

_____ tangible rewards such as tokens which can be traded for food, prizes

_____ physical attention such as a hug, a pat on the back

_____ symbolic rewards such as grades, stars

_____ competitive rewards such as being named the winner

_____ comments of approval (verbal praise) from an adult

_____ comments or indications of approval from peers

_____ opportunities to pursue activities of his own choosing

_____ knowledge of results such as being told an answer is correct

Place a check mark next to statements which apply to the child.

_____ exhibits a strong preference for a certain type of reward; if so, specify_____

_____ does not display a preference for any one type of reward but works well for a variety of rewards

_____ needs to be rewarded several times during completion of a task

_____ can delay receiving reward until completion of task

_____ can delay receiving reward until several tasks are completed

Comment: _____

_____

_____

_____

Name of Child: _____

III. Physical Symptoms Check List

Place a check mark next to the statements which apply to the child. Use the comment space to elaborate and provide supporting information. Attach any medical reports which are available.

_____ is often absent

_____ is usually tired

_____ is overly active

_____ is listless, lethargic

_____ is underweight

_____ is overweight

_____ complains of headaches, dizziness

_____ has unusual posture when doing visual tasks

_____ has unusual posture when standing

_____ has unusual gait

_____ appearance of eyes is abnormal

_____ has frequent earaches

Comment: _____

_____

_____

_____

Name of Child: _____

IV. Social-Emotional Behaviors Check List

Place a check mark next to the statements which apply to the child. Use the comment space to elaborate and provide supporting information. Attach parent conference reports, if any.

_____ prefers working with others

_____ prefers to work by himself

_____ exhibits about equal willingness to work with others and alone

_____ gets along with others in work situations

_____ gets along with others in play situations

_____ refuses to participate in group activities

_____ adapts easily to changes

_____ needs to be carefully prepared and gradually introduced to change

_____ behavior in group activities is predictable

_____ is more easily excited than others his age

_____ has temper tantrums (kicks, screams, beats on floor, etc.)

_____ makes a deliberate attempt to be by himself

_____ exhibits an unusual amount of persistence

_____ gives up and moves to another activity when he experiences difficulty

_____ is aggressive (fights, kicks, hits, verbal insults, etc.)

Comment: _____

_____

_____

_____

APPENDIX B

STUDENTS' TRACE CHAINS

KEY FOR STUDENTS' TRACE CHAINS

Code	Requested Information For All Children	Time Counter Advances
A	Kindergarten record	1
B	Readiness tests	1
C	Sociogram	1
E	Observation	With each comment
D_1	Work samples	1
D_2	Drawing samples	1
	Requested Information For One Child	
F_1	Biographical data	0
F_2	Medical data (hearing & vision test)	0
G	School achievement	0
H_1	Parent's comment	1
H_2	Mrs. Thomas' opinion	0
I	Observational comments	With each comment
L_1	Work sample	0
L_2	Drawing sample	0
M	Speech sample	0
C_1	Sociogram	1
N_1	Draw-A-Man Test	0
N_2	First Grade Screening Test	0
O	Metropolitan Readiness Test	0
P_1	Self report	1
P_2	Denver Developmental Screening Test	0
P_3	Individual profile	0
P_4	Psychological report	0

Code	General Information
DFB	Feedback for excentional child
NFB	Feedback for normal child
FB	General feedback when student tries to sign off
TC	Value of time counter
C = X	X - 1 is the number of assists the student needed to make a correct decision

Example Student Record #1

Information for all children:

A, D_1, B, TC = 3

Information for Child Z:

H_2, F_2, P_1, P_1, P_4, P_2, P_3, H_1, H_1, H_1, H_1, H_1, F_2, I, G, M, L_1, L_2, N_2, O, TC = 29

Student comment on Child Z:

Mike seems to have a great deal of difficulty in his working with others his own age. His visual problems seem to cause him trouble in working with the alphabet. He cannot discriminate between sounds and needs work in beginning consonants and phonograms. He would rather be by himself and it seems to be apparent that he has trouble relating to those his own age.

DFB, C = 1

Information for Child X:

F_1, H_2, L_1, M, L_2, P_1, P_4, F_2, P_2, P_3, H_1, H_1, H_1, H_1, H_1, G, F_2, I, TC = 40

Student comment on Child X:

Paul seems to be having trouble in his auditory perception. Several comments were made by his parents about his not listening. Shows only a strong desire to finish his work. Seems to be apathetic toward social encounters of any kind.

DFB, C = 1

Information for a normal child:

F_1, H_2, P_1, P_4, P_2, P_3, L_1, L_2, H_1, I, O, N_2, C, G, NFB, NFB, C = 2, TC = 51

Information for a normal child:

NFB, C = 1, TC = 51

Information for Child Y:

H_2, N_2, O, G, P_1, P_4, P_3, I, H_1, H_1, H_1, H_1, H_1, F_2, TC = 61

Rosa is not retaining the information. I think her hearing has something to do with this. She seems very apathetic about social interaction but does show desire to have a best friend. She seems to be having some psychological problems along with some hearing problems.

DFB, C = 1

Sign off FB, C = 1, TC = 61

Example Student Record #2

Information for all children:

D_1, B, E, TC = 68

Information for Child Z:

F_1, H_1, H_1, H_1, H_1, H_1, F_2, H_2, I, M, L_2, TC = 75, L_1, L_1, L_1, L_1, L_1, L_2, L_2, L_2, L_2, L_2, M, M, L_1, L_1, F_2, F_2, P_4, P_3, P_1, P_2, C, TC = 77, N_1, N_1, N_2, N_1, N_1 N_2, O, I, TC = 181 (programs signed student off after reaching the end of the simulated school year)

Example Student Record #3

Information for all children:

A, B, C, TC = 3

Information for a normal child:

F_1, G, H_2, I, NFB, C = 1, TC = 15

Information for Child X:

F_2, P_2, P_1, P_4, DFB (assist), P_3, P_4, DFB (assist), L_1, TC = 16

Student comment on Child X:

Auditory problems hamper input causing general problems for Ella in all but reading.

DFB, C = 3

FB (student tried to sign off - assist)

Information for Child Y:

F_1, H_2, P_1, P_2, P_4, P_3, F_2, F_2, O, L_1, DFB (assist), H_1, H_1, H_1, H_1, I, DFB (assist), F_2, I, N_2, N_1, O, TC = 51

Student comment on Child Y:

Paul lacks reading readiness skills which would make it difficult to go on. He needs this readiness basis.

DFB, C = 3

Information for Child Z:

F_1, F_2, G, H_1, H_1, H_1, P_2, P_1, L_1, TC = 55

Student comment on Child Z:

He has visual problems due to his visual deficiencies. This will also effect his motor output.

DFB, C = 1

Sign off, FB, C = 2, TC = 55

APPENDIX C

DATA STORAGE NO-OP FORMATS

TABLE NAME (LABEL)	CHARACTER LENGTH OF COMMENT PORTION OF THE NO-OP	USAGE	MODULES REFERENCING
FIVALS	120	Biographical data	F1
GSAVE	72	Previous grade reports for school achievement	G
PKSAVE	204	Names and grades for preschool and kindergarten record displays	PKREC
SAVEC	204	Saves quasi-counters C50 - C150 for RESTART	All
S4SAVE	158	Pools of slide numbers for work and drawing samples	L1, L2
TRACE	99	TRACE chains	All

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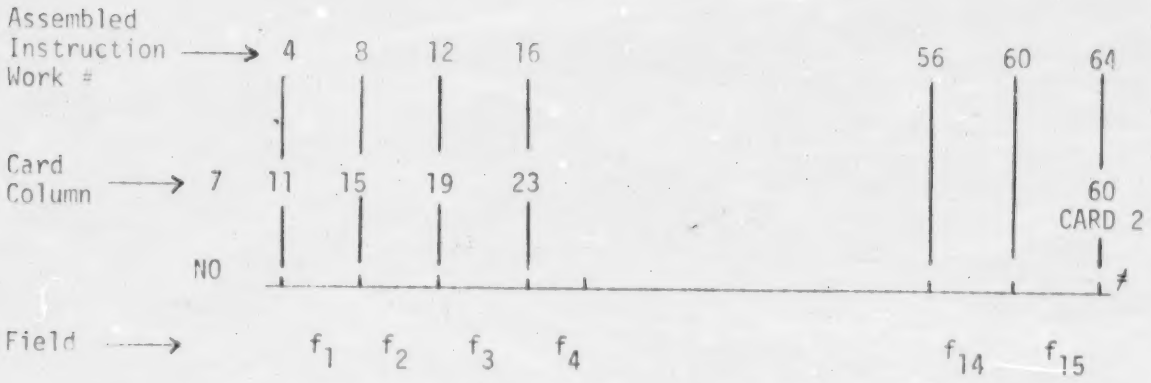
FIVALS NO-OP FORMAT



Stored in each of the 15 fields of the instruction are four numeric values pointing to items in the biographical data pools for each of the 15 children in the simulated class. From left to right in each field, these values represent:

1. father's occupation and schooling,
2. mother's occupation and schooling,
3. parents' names,
4. comment (if any).

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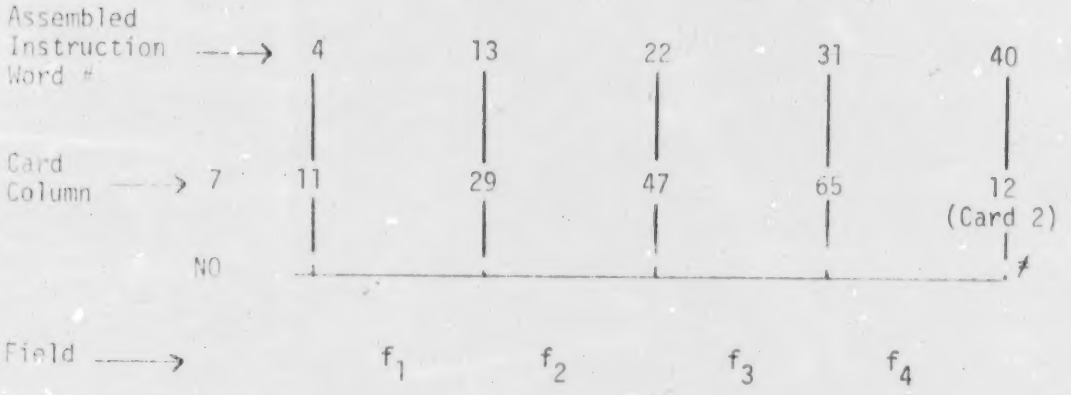
GSAVE NO-OP FORMAT



Stored in each of the four fields of the instruction are previous grade reports for an individual child's school achievement record. Each previous report is formatted and stored in the no-op only when the simulation time counter reaches a new "quarter" of the school year.

The format of the 18-character grade set stored in each field is as follows:

gg.gg.gg.gg.gg.gg/

where gg is the grade ("S_A", "S-", or "U_A")
. is a grade delimiter
/ is a grade set delimiter

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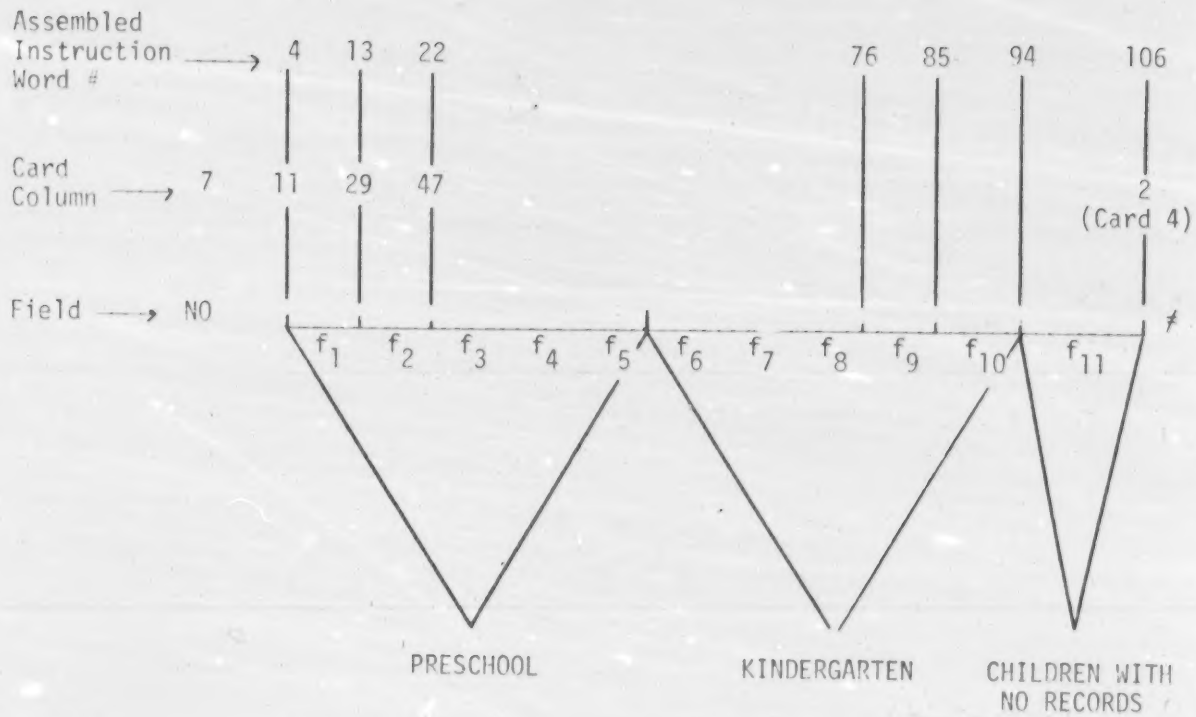
PKSAVE NO-OP FORMAT



Fields 1-10 are in the following format:

cccc.gg.gg.gg.gg.x

where cccc is the child's name
gg is a grade ("S_A", "S-", or "U_A")
. is a delimiter
x is a numeric value pointing to a line in the comment pool PKCØMN or PKCØMY

Field 11 is in the following format:

cccc.cccc.cccc.cccc.cccc

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SAVEC NO-OP FORMAT

At restart points in the program, quasi-counters C50-C150 (202 bytes) are written with no conversion into the no-op.

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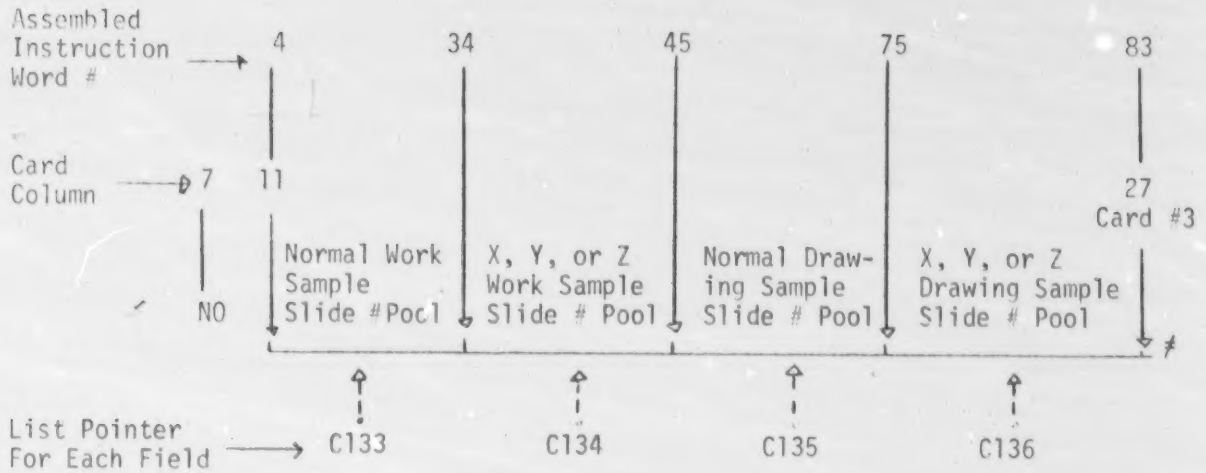
S4SAVE NO-OP FORMAT



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Random sequences of slide numbers are generated in counters and written into the appropriate field via function PSREMV. When a list pointer of a given field is incremental to the end of the field, it is reset to zero so that on subsequent requests a new sequence will be generated and stored. The field pointers contain word numbers of the instruction.

POINTER	IF VALUE IS	THEN
C133	0	generate early work sample set and set C133 = 4.
	-1	generate advanced work sample set and set C133 = 4.
	$4 \leq C133 \leq 33$	get slide # from this word of the instruction.
C134	0	generate work sample set for x, y, or z child.
	$34 \leq C134 \leq 44$	get slide # from this word of the instruction.
C135	0	generate normal drawing sample set.
	$45 \leq C135 \leq 74$	get slide # from this word of the instruction.
C136	0	generate drawing sample set for x, y, or z child.
	$75 \leq C136 \leq 82$	get slide # from this word of the instruction.

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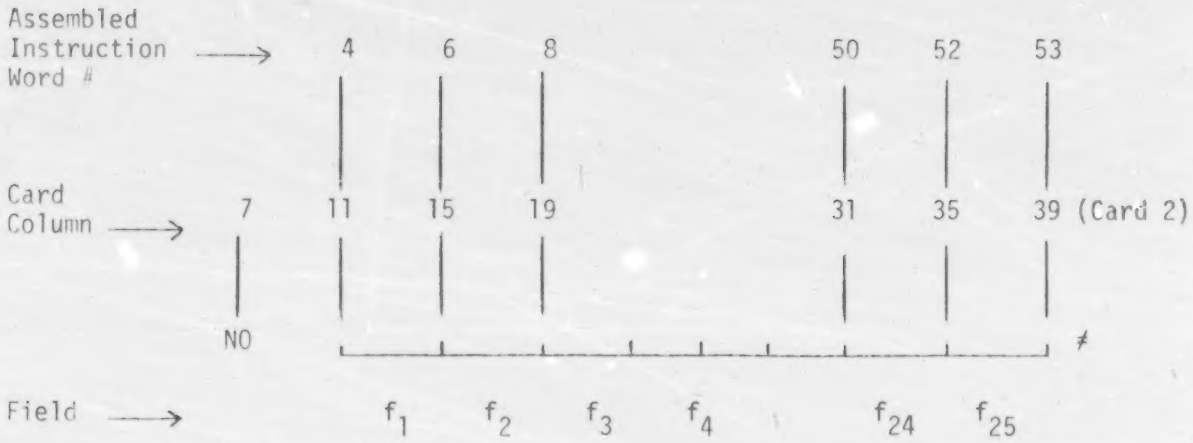
TRACE NO-OP FORMAT



Each time a module is entered, four characters are written into the trace chain at the word number specified in C28. If C28 is pointing to field 25 when a new set of characters are to be written, the chain is dumped to the proctor terminal, C28 is reset to 4, and the characters written. Field 25 is not used.

Restrictions and Program Changes

Because of the use of no-op data storage, several minor restrictions have had to be imposed on student (trainee) sign-on numbers and for authors executing the course.

CARE S currently allows for up to 99 students to be taking the simulation simultaneously. To insure that a student is in the range 001-099, the program tests the last 3 digits of the sign-on number at the initial sign-on by a student. The number 000 is reserved for authors (alphabetic characters are treated as zeros). After all initialization is completed by the program, a pointer to the correct sequence number in the storage tables is stored in a counter. This pointer is the last two digits of the sign-on number plus one.*

If it is desired to change the limits of the number of students which can simultaneously take the course, it will then be necessary to increase or decrease the number of no-ops in each table, as well as to make corresponding adjustments in the tests (*) above. Major program revisions such as changing the generated class size to larger than 15 students will entail redesigning the primary data structures and function TSTSW.

Authors executing the course from the beginning will get the "illegal number" message. They may continue by entering the passkey "return return backspace." Authors should exercise caution in doing partial execution of CARE S without being sure of the correct counter values. Information stored for a student could thus be changed or wiped out, or a system error could result.

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